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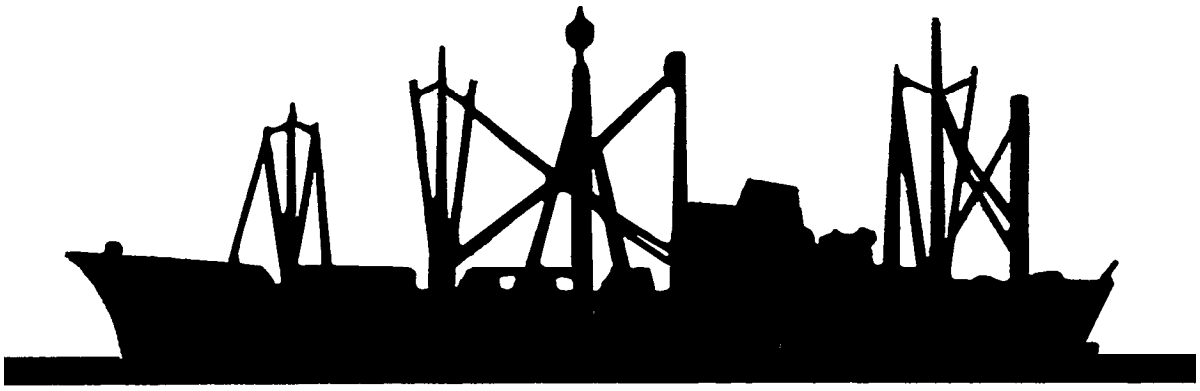

INSTITUTE FOR RESEARCH AND ENGINEERING FOR AUTOMATION AND PRODUCTIVITY IN SHIPBUILDING

IREAPS

A PRACTICAL APPROACH TO USING STANDARD SOFTWARE PACKAGES IN SMALL SHIPYARDS

George H. Hoffman
Director of Steel Operations
St. Louis Ship
St. Louis, Missouri

ABSTRACT

In the growth of a shipbuilding concern, a time arrives when manual efforts to control cost and report status become undesirable. However, when an attempt is made to apply readily available software, many obstacles are presented.

One approach to avoid many of these obstacles is addressed. By describing vessel construction through a network of dated work orders, and the treating of this network as a structured bill of material, standard software packages can be used to manipulate the data necessary to provide material requirements planning and job cost accounting. Critical issues impacting the selection and successful implementation of computerized systems are also discussed.

INTRODUCTION

In the growth of a small shipbuilding company, a time arrives when manual efforts to control costs and report status become ineffective. If the company is to continue to be successful it will need to produce more of its product at the same cost or the same amount of product at a lower cost. Besides improved facilities, better controls are needed on costs if these goals are to be attained. In the past small shipyards were able to see the need for controlling the cost of manhours much more visibly than the need to control the cost of their materials. However, in recent times the cost of money has directed more light on material and inventory control. Managing with huge piles of raw materials stacked in front of the labor can no longer be tolerated. The associated simple systems for stock piling needed materials do not represent an efficient way of supporting production.

Many companies attempted to eliminate their material control problems through buying all materials directly to the job. This solution was found ineffective since the shipbuilding business is based on signing contracts with minimum lead time, which is not compatible with direct purchasing from vendors with long lead times. Missed delivery schedules quickly impacted production manhours adversely.

Attention was then turned to managing inventories with tighter controls, increasing material planning efforts, and monitoring job progress more closely. The only way such controls could be obtained short term was to add personnel in the support functions of production and inventory control.

However, as departments grew, they became less effective, owing to duplication of effort and reduced overall professional ability as a result of available, but untrained personnel, being pressed into jobs they were not qualified to fill. The manual systems designed to control costs soon became subject to greater errors than before and confidence in their accuracy and effectiveness diminished rapidly.

The need for expanded use of the company computer became obvious to those who thought, "Our overhead will not continue to grow if we rely on better use of the computer". However, probably no one in the organization had any idea as to how best to tap this great resource. Usually the company had a computer on which it had been processing accounting, payroll, and personnel records, but little involvement in the control of its material and job progress.

SOFTWARE ALTERNATIVES

The question now becomes: "How to expand the computer's capabilities to solve the problem?" There are three alternatives: (1) develop software using in-house personnel, (2) pay a software design agent to develop new packages, or (3) purchase standard multi-function packages and modify them to suit local needs. The choice of which alternative to pursue is dependent on the extent the existing systems must be upgraded. If most of existing automated systems are satisfactory but one area needs improvement, then the choice falls between the first two alternatives. An in-house effort would be the least costly, but is slower compared to software design agents that are usually more expensive but will provide a quicker solution. However, this paper will address the need for extensive new systems and in that case

alternative #3 is the best choice.

The development of a comprehensive automated control system with integrated functional modules is an extremely complex task. Few in-house data processing departments have systems analysts and programmers who understand manufacturing control systems well enough to provide the detailed programming which would duplicate most of the significant functions of a comprehensive Manufacturing Resource Planning (MRP) software package. Even if the company had a few of these people, they would not be enough to carry out a total system development program. Immediate expansion by hiring new personnel is not the right answer. It is unlikely that the newcomers will understand the ship-building business and its unique characteristics, thus delaying progress while they become acclamated.

The argument against using a software design agent to develop MRP software packages for your specific needs is simple; why bother re-inventing when you can spend that time and resource modifying a system already designed for someone else? One advantage of working with a developed set of packages is that the functional inter-relationships are already debugged through efforts of previous installations. Another advantage is that the cost and time required in modifying an existing set of packages are significantly less than developing your system from scratch. Another disadvantage associated with the use of design agents is that your data processing personnel do not become know-ledgeable in the detail workings of the packages. The vendor wants to continue providing upgrade service in the future rather than have you proceed on your own.

The use of ready made packages is not problem free. It is difficult to locate vendor software which meets the needs of a small shipbuilding company. Lack of in-house knowledge of what's available, due to minimal exposure to software state-of-art, is as much a part of this problem as the size of the software market represented by the low volume make-to-order shipbuilding companies. Most packages are tuned to high volume manufacturing or at least manufacturing in the environment of structured bills of material. The software salesmen do not understand the shipbuilding environment or how to relate their capabilities to the manufacturing needs. This situation is compounded since most shipbuilding people do not understand high volume manufacturing and its controls either.

It is important that the software vendor salesmen not be allowed to overpower the in-house systems people. To avoid this situation, production and inventory control personnel must undertake an educational upgrade program in classical theory and its application in the state-of-art software as well as in shipbuilding. This should be an on-going effort sponsored by top management. The idea is to stay up with improvements in the software and to be able to interpret their value for application to a shipbuilding environment.

During the review of available software systems it will become clear that most operate well only when a tightly structured bill of material exists where all parts have unique part numbers, and when those parts are scheduled individually. Highly structured bills of material are not present in most small shipbuilding companies. Without detailed levels of a bill of material with discreet part numbers it will be impossible to use standard MRP soft-ware. The use of phantom part numbers for sub-assembly

stages as part of the bill of material, which might be the proposed solution from a salesman, is a difficult concept to accept. Without this solution, vendors are at a loss to fit their packages to your system. What is needed then is a bill of materials for shipbuilding that defines the product structure without imposing additional complex concepts on the organization.

WORK ORDER SYSTEM

Most shipyards utilize work order systems which define portions of work for a given vessel or contract. These work order systems can be used as a structured bill of material if the work order itself is designed properly. The key characteristics of this type work order are: a charge number, a scope of work, a list of materials involved, the source of those materials, and the next work order to be fed. The work order identification number is the time charge number which describes the cost account and type of work to be done. It also identifies a particular work scope from a master listing of work scopes. The scope of work is a task description provided initially by production as a manageable amount of work. A complete library of such tasks can be written which would build all of the company's products. Essentially, these work scopes provide the production engineering breakdown of the contract drawings into manufacturing modules. The materials required to accomplish the task described by the work scope are listed along with their sources. These sources are either purchase order numbers, inventory part numbers, or other work order numbers. By also showing the next work order that the completed pieces feed, a linking of all work orders is accomplished. Therefore, a network of work orders is formed which can be treated as a structured bill of material having work order numbers acting as phantom sub-assembly part numbers. Since these numbers are used daily by production personnel for time

charging, their use in an MRP system will not be misunderstood or distrusted. By scheduling the work orders, a direct input can be made to an MRP package listing materials by their quantities and date required. Using the work order numbers as phantom parts allows the MRP logic to sum to the lowest level to determine raw material requirements. Since manhours are charged to work orders as well as materials, the capability to sum up materials and labor costs at each step of production will exist. Such a work order system then provides the link between present day MRP software and the shipbuilding manufacturing environment.

IMPLEMENTATION PLAN

Given this link, the question becomes "How best to proceed towards upgrading the manufacturing control system?" The best approach is to review the total operational logic of the company's functions with emphasis on information requirements of each function. As each function is analyzed in relation to how its existing design and operation fits into the total picture, problem areas will be highlighted. In many cases potential solutions to these problems will become apparent as one function is compared to another. Some problems will call for further analysis; and, priority for further effort will be established. The output of this review will be the purchase specification for vendor software and an implementation plan for upgrading the management information systems. In order to facilitate on-the-spot decision make during the review, a team of top management personnel should be assembled to carry out the analysis. This also insures a high level of project sponsorship, the single most important key to success of such an implementation plan. Finish the team project with a financial analysis of the costs and benefits of your implementation plan with emphasis on measureable benefits to provide justification for proceeding and controls for monitoring progress.

There is one other key issue that needs to be addressed as efforts are made to upgrade the control systems; and, that is data accuracy. Before any automated system can serve the use effectively, the data input must be accurate. How accurate? Over 95% accuracy is the accepted number. Developing new systems without accurate input data is a waste of effort. The point is that efforts to improve record accuracy must run concurrent to systems design and in fact, must be successfully completed before the new systems are implemented.

SUMMARY

As the volume of business grows in the face of an increasing need to more closely control costs, a way must be found to automate the company's control systems. For upgrading an overall manufacturing resource planning system, the best approach is to modify existing vendor software packages. To do this in a shipbuilding environment requires a means for developing structured bills of material. The production work order system can be used to provide this element of the control system. A review of the company's total information needs must be carried out by a top management team. Educational programs are needed to upgrade in-house personnel in the latest manufacturing resource planning techniques. These efforts provide the base for acquisition of the appropriate vendor software to make up an automated control system for production and materials in small shipbuilding companies.